

WHAT IS CLAIMED IS:

- 1 1. An anastomosis device for connecting a graft vessel to a target
2 vessel, the device comprising:
3 a first linkage formed of a plurality of struts and a plurality of axial
4 members, the first linkage expandable from a first configuration in which the first
5 linkage is a substantially tubular shape to a second configuration in which the first
6 linkage includes a first outwardly extending flange;
7 a substantially tubular connecting portion extending from the first
8 linkage; and
9 a second linkage configured to form a second outwardly extending
10 flange spaced from the first outwardly extending flange.
- 1 2. The anastomosis device of Claim 1, wherein the plurality of axial
2 members each include a hinge for concentrating bending of the axial members
3 during formation of the first outwardly extending flange.
- 1 3. The anastomosis device of Claim 1, wherein the plurality of struts
2 form a plurality of diamond shapes which contract in an axial direction of the
3 device when the device is outwardly expanded.
- 1 4. The anastomosis device of Claim 3, wherein the plurality of axial
2 members are each positioned within a corresponding one of the diamond shapes
3 such that as the diamond shapes contract in the axial direction the axial members
4 bend outward to form the first outwardly extending flange.

1 5. The anastomosis device of Claim 1, wherein the plurality of axial
2 members are inner diamond shaped members connected to the plurality of struts at
3 top and bottom corners and including two hinges at side corners.

1 6. The anastomosis device of Claim 1, wherein the second linkage is
2 formed of a plurality of struts and a plurality of axial members, and the second
3 linkage is expandable from a first configuration in which the second linkage is a
4 substantially tubular shape to a second configuration in which the second linkage
5 forms the second outwardly extending flange.

1 7. The anastomosis device of Claim 1, wherein the second linkage is
2 formed of a plurality of pull tabs configured for holding the anastomosis device
3 during insertion.

1 8. The anastomosis device of Claim 1, wherein the substantially
2 tubular connecting portion is radially expandable.

1 9. The anastomosis device of Claim 1, wherein the first outwardly
2 extending flange is conical.

1 10. The anastomosis device of Claim 1, wherein the second outwardly
2 extending flange is conical.

1 11. An anastomosis device for connecting a graft vessel to a target
2 vessel, the device comprising:
3 a body formed from a plurality of struts and deformable from a first
4 configuration in which the device is substantially tubular to a second configuration

5 in which the device includes a first flange and a second flange spaced from the
6 first flange.

1 12. The anastomosis device of Claim 11, wherein:
2 a first end of the body includes a first linkage which changes from a
3 substantially tubular configuration to an outwardly extending configuration to form
4 the first flange upon radial expansion of the first end by an expander positioned in
5 a center of the body; and
6 a second end of the body includes a second linkage which is
7 configured to form the second flange upon deployment of the device.

1 13. The anastomosis device of Claim 12, wherein the first linkage
2 includes a plurality of struts arranged in a configuration such that an axial
3 dimension of the first linkage changes upon outwardly expansion of the linkage.

1 14. The anastomosis device of Claim 13, wherein the first linkage
2 includes a plurality of folding members which are caused to fold outward by the
3 change in axial dimension of the first linkage.

1 15. The anastomosis device of Claim 14, wherein the folding members
2 are axially members with central hinges.

1 16. The anastomosis device of Claim 14, wherein the folding members
2 are diamond shaped members having two central hinges.

1 17. The anastomosis device of Claim 12, wherein the first linkage
2 includes a plurality of members which are caused to fold outward tangentially to
3 the device by the change in the axial dimension of the first linkage.

1 18. The anastomosis device of Claim 11, wherein the first and second
2 flanges each form an angle between about 45 and 100 degrees with an axis of the
3 body.

1 19. The anastomosis device of Claim 11, wherein the first flange is
2 formed by outwardly pivoting a plurality of substantially axial members which are
3 supported by the plurality of struts.

1 20. The anastomosis device of Claim 11, wherein the first flange and
2 the second flange are spaced apart a distance sufficient to accommodate a wall of a
3 blood vessel.

1 21. An anastomosis device comprising an expandable body, the
2 expansion of a portion of said body forming a first flange extending outwardly
3 from said body.

1 22. The anastomosis device of Claim 21, wherein the expansion of a
2 second portion of said body forms a second flange extending outwardly from said
3 body.

1 23. The anastomosis device of Claim 21, wherein the first flange is
2 formed by outwardly expanding a four bar linkage which is provided on said
3 body.

1 24. The anastomosis device of Claim 23, wherein the four bar linkage
2 is formed by a plurality of struts arranged in a plurality of interconnected
3 substantially diamond shapes.

1 25. An anastomosis device comprising a body of elements which form
2 movable linkages, expansion of the body activates said linkages to form a flange.

1 26. The anastomosis device of Claim 25, wherein the movable linkages
2 include hinges and wherein expansion of the body causes the hinges to bend to
3 form the flange.

1 27. The anastomosis device of Claim 25, wherein the flange is formed
2 at a distal end of the body and a proximal flange is formed at a proximal end of
3 the body.

1 28. The anastomosis device of Claim 27, wherein the proximal flange is
2 formed by expansion of said body.

1 29. The anastomosis device of Claim 27, wherein the proximal flange is
2 formed of a plurality of pull tabs configured for holding the body during insertion.

1 30. A method of performing anastomosis comprising:
2 providing a one-piece tubular anastomosis device;
3 everting an end of a graft vessel around the anastomosis device;
4 puncturing a target vessel with a trocar;
5 inserting the tubular anastomosis device with everted graft vessel

6 into the puncture in the target vessel;
7 radially expanding the tubular anastomosis device with an expander
8 to cause a portion of the tube to fold outward forming a first annular flange; and
9 forming a second annular flange on the anastomosis device to trap a
10 wall of the target vessel between the first and second annular flanges and seal the
11 graft vessel to the target vessel.

1 31. The method of Claim 30, wherein enlargement of an internal
2 diameter of the anastomosis device with the expander causes the formation of the
3 first flange.

1 32. The method of Claim 30, wherein the device is expanded by
2 advancing an expander with an outer diameter greater than an inner diameter of
3 the anastomosis device into the anastomosis device.

1 33. The method of Claim 32, wherein the withdrawal of the expander
2 causes formation of the second flange.

1 34. The method of Claim 33, wherein a groove on the expander catches
2 at least a portion of the anastomosis device to form the second flange.

1 35. The method of Claim 30, wherein the device is expanded by an
2 expander in the form of an inflatable balloon.

1 36. The method of Claim 30, wherein the radial expansion of the
2 anastomosis device causes a portion of the device to bend at a plurality of hinges
3 to form the first annular flange.

1 37. The method of Claim 30, wherein the first and second annular
2 flanges each form an angle between about 45 and 100 degrees with an axis of the
3 device.

1 38. An anastomosis device deployment system comprising:
2 a handle;
3 a holder tube attached to the handle, the holder tube having a distal
4 end configured to hold the anastomosis device with an attached graft vessel; and
5 an expander positioned within the holder and slidable with respect
6 to the holder to a position at which the expander is positioned within the
7 anastomosis device and radially expands the anastomosis device.

1 39. The system of Claim 38, further comprising a trocar movable with
2 respect to the holder tube to form an opening in a target vessel to receive the
3 anastomosis device and attached graft vessel.

1 40. The system of Claim 39, wherein the trocar is a split trocar which
2 is slidable over the holder tube and the anastomosis device.

1 41. The system of Claim 38, wherein the handle includes two cam
2 grooves, and the holder tube and expander each have a follower member engaged
3 in one of the cam grooves to move the holder tube and expander with respect to
4 one another upon activation of a trigger of the handle.

1 42. The system of Claim 38, wherein the distal end of the holder tube
2 includes a plurality of slits for receiving pull tabs of the anastomosis device.

1 43. The system of Claim 38, wherein the distal end of the holder tube
2 includes a plurality of hooks for receiving pull tabs of the anastomosis device.

1 44. The system of Claim 38, wherein the distal end of the holder tube
2 includes a plurality of flexible fingers which each receive a pull top of the
3 anastomosis device, the flexible fingers flexing outward to form a proximal flange
4 on the anastomosis device.